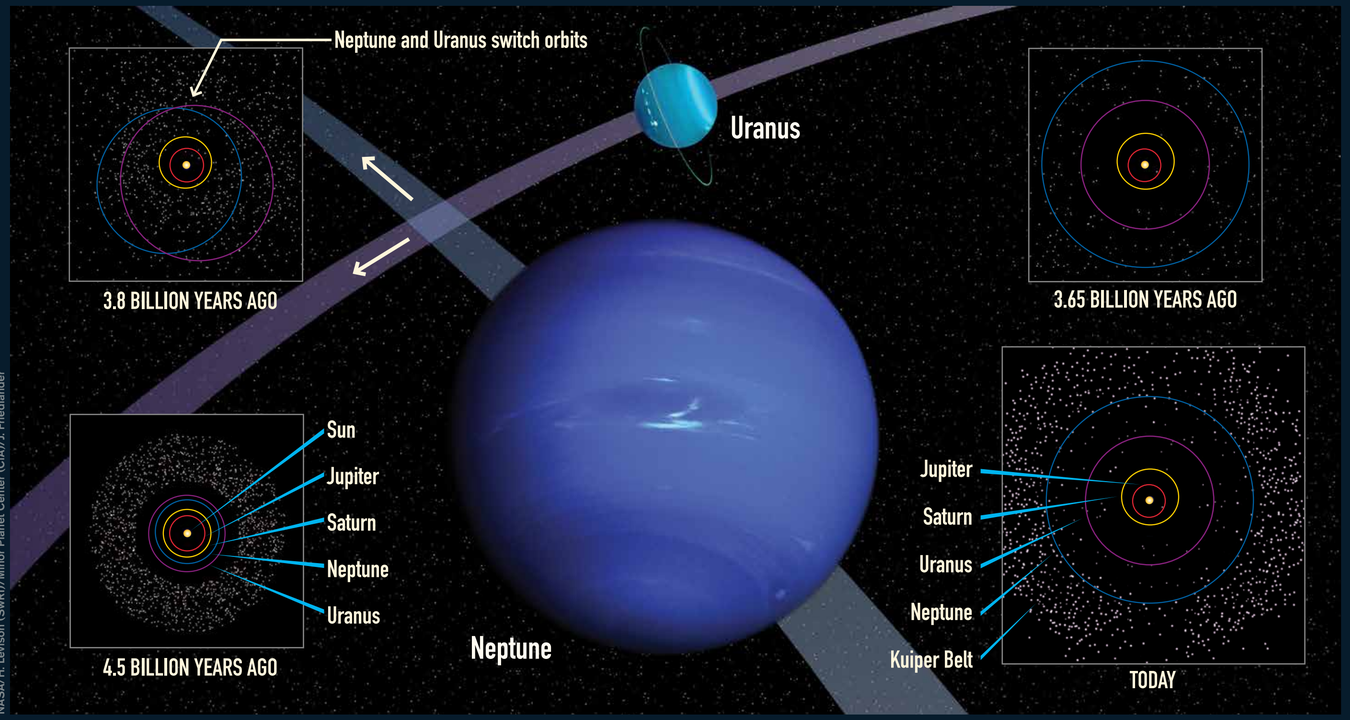
STATION 05 Goddard Initiatives

Rearranging our Planetary System

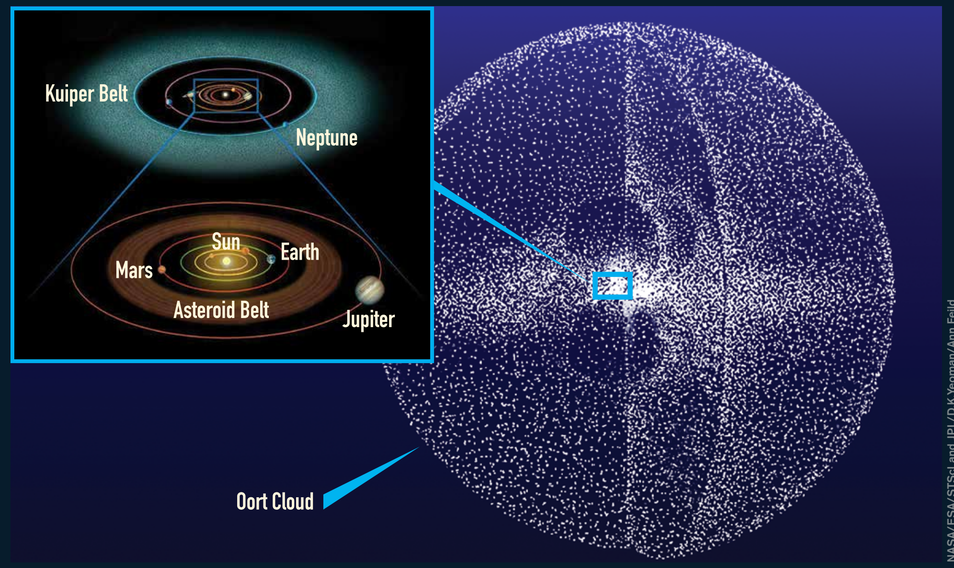
The early Solar System probably started with the four giant planets in a compact configuration closer to the Sun, and in the order Jupiter, Saturn, Neptune and Uranus. Detailed simulations of planetary interactions suggest that when the orbits of Jupiter and Saturn fell into lockstep, their combined gravitational pull caused Neptune and Uranus to switch places and move outward. This triggered the dispersal of an outer disk of icy debris and 90% of a disk of rocky bodies between Mars and Jupiter, causing the Late Heavy Bombardment of Earth and the Moon. The remaining 10% form today's asteroid belt.



NASA/H. Levison (SwRI)/Minor Planet Center (CfA)/J. Friedlander

TRADING PLACES: Shortly after their formation, the giant gas planets follow nearly circular orbits close to the Sun (lower left). About 3.8 billion years ago, Neptune and Uranus switch places and trigger major disruptions (center & top left). Then the giant planets settle into their current orbits, the Kuiper Belt and Oort Cloud comet reservoirs form, and the major bombardment ends (top right). Lower right: Detected Kuiper Belt objects.

Comet and Asteroid Reservoirs Today



NASA/ESA/STScI and JPL/D.K.Yeoman/Ann Feild

Icy bodies are ejected from the Oort Cloud by passing stars and galactic tides, and from the Kuiper Belt by planetary perturbations. Each year, some icy bodies enter the inner Solar System and become active comets. Asteroids reside much closer to the Sun, in a stable belt between Jupiter and Mars.

DID YOU KNOW?

Comets currently occupy at least two reservoirs: the Kuiper Belt, where Pluto resides, and the Oort Cloud. The Oort Cloud contains about 1,000 billion comets and extends halfway to the nearest star.